SHORT COMMUNICATION

An interpretation of the pattern of tetracycline lines in a deciduous molar

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Introduction

From a macroscopic study of the teeth obtained from the skulls of children excavated at the ruins of the mediaeval monastery near Æbelholt, Zealand, Jørgensen in 1950¹⁾, described various ways that root bifurcations could be established, and suggested a number of anatomical terms to describe the various appearances in this region. Ooë⁴⁾ (1973) using a histological approach made observations on the relationship of the epithelial root sheath processes with each other and the interradicular tongues of dentine formed in relationship to this epithelium, as the initial stage of the pulpal floor becomes established. Both these workers describe that in addition to the interradicular tongues, termed by Jørgensen subpupal lobes (*Lobi subpulpales*), small isolated dentinal islands, were found in this region, which they interpreted as separate centers of dentine formation.

Acquisition by chance of a human deciduous lower second molar extracted from a child who had received repeated doses of tetracycline, enabled the authors to examine the incremental pattern in dentine with greater ease than in unlabelled specimens. Moreover, since the authors have established previously²⁾ that human therapeutic dose levels of tetracycline do not unduly interfere with the growth rate of dentine formation in a major way, it was thought that some useful information could be gained by comparing the relative rates of growth of the

coronal dentine and the interradicular dentine forming the sub-pupal floor.

Materials and Methods

The extracted human lower right second deciduous molar was fixed in 10% neutral formalin solution and serial longitudinal sections cut mesio-distally with a thin abrasive disc. Sections from the mid-line region of the tooth were then ground manually to a thickness of 60 μ m. The sectioned teeth then were examined with a Nikon, Sur-F fluorescent microscope and more than twenty-six tetracycline lines were revealed. The distance between neighboring tetracycline lines in the dentine formed in relation to the same group of odontoblasts was measured on photomicrographs at a magnification of $\times 73.6$. The separation between each pair of fluorescent lines in the crown dentine was measured in six places, two along the mid-axis of the mesial and distal side (Fig. 1, B & D), two on the cervical line of the mesial and distal side (Fig. 1, A & E), one along the mid-axis of the occlusal wall of the pulp-chamber (Fig. 1, C), and the other along the mid-axis of floor of the pulp-chamber (Fig. 1, F). The direction of measurement in all cases was along the path of the dentinal tubules. Since tetracycline is deposited at the mineralizing front of the dentine, the differences in distances between two adjacent tetracycline lines in different parts of the dentine must be a measure of the differences in the rates

Fig. 1 The photomicrograph of the human lower right second deciduous molar show that the fluorescent tetracycline antibiotic was incorporated more than twenty-six times. The separation between each pair of fluorescent lines was measured in six places (A-F) for comparing the rate of dentine formation in different regions.

of dentine formation in these different parts during the period between successive tetracycline treatments. Although it was not possible to establish an absolute rate of dentine formation from the material available, it was possible to create a growth rate reference index with which growth rates in different regions could be compared meaningfully³⁾. In this deciduous molar, the separation of the corresponding pairs of lines in different parts of the crown and the floor of the pulp-chamber were measured and expressed as simple ratios. It was thus possible to compare in a simple way the growth in these two different parts of the tooth.

Results

The first tetracycline line of the floor of the pulp-chamber nearest to the cementum

corresponds to the third tetracycline line from the cusp side (Fig. 1, X & X'). This line is located 0.5 mm below the cervical line on the mesial side and 0.2 mm on the distal side. The tetracycline line appears to start at the dentine-cementum junction, follows a convex curve toward the pulp-chamber and then passes down to end at the dentine-cementum junction on the opposite side. Two regions of the tooth were selected for study to compare the relative rates of growth between the subpupal, interradicular dentine and the coronal dentine. The interradicular dentine of the floor of pulp-chamber can be divided into two phases, A & B, by a demarcation line formed by the change in direction of the primary curvature of the dentine tubules (Fig. 2, arrows). Thus, it was possible to compare in a simple way, the growth rates in different parts of each of these two

Fig. 2 The high-power photomicrograph of the interradicular dentine of the floor of pulp-chamber shows the two phases A & B, referred to in the text which are divided by a demarcation line (arrows).

phases. The relative values of the growth rates are shown in Figure 3, and it can be seen that at the time the interradicular dentine begins to form, the coronal dentine is growing more rapidly. Moreover, the interradicular dentine maintained this slow rate of growth, with only small variation, throughout the formative period in this tooth. The interradicular dentine described as phase two in this study, corresponds to the series of tetracycline lines which come together at the apex of the two pulpal horns (Figs. 1 & 3). In these regions, dentine formation had al-

most ceased at the time of the antibiotic treatment, whereas, further down the root, as can be seen from the progressively wider separation of the lines in the middle region of the interradicular dentine, the rate of dentine formation in the root is faster than and has overtaken that of the interradicular dentine which is continuing to form at approximately a steady rate.

Discussion

Examination of the tetracycline lines in Fig. 1 shows quite clearly that dentine formation in relationship to the mesial pulp horn (Y) had stopped before the dentine over the distal pulp horn (Y'), although dentine formation was continuing at varying rates in different parts of the root—for example, rather rapidly at point P in the distal root but at a fairly slow but steady rate in the interradicular region. These observations add further support to the conclusion reached as a result of the earlier work of the authors³⁾, that the odontoblast's formative activity starts slowly, reaches its most active phase and then slows down as the full width of the dentine is established. The specimen described in this study also shows that odontoblasts in different parts of the crown, for example, in regions Y & Y', have different life spans since the dentine thickness is greater over the pulp horn Y' than Y.

A comparison of the shapes of the lines in Figs. 1 & 4 also reveals that the contour

Fig. 3 A tracing showing the relative values of the growth rates in different parts of each of two phases of both the subpulpal and the coronal dentine.

Fig. 4 A photomicrograph of a human upper premolar showing a more sigmoid shape of the contour pattern in the cervical root region.

pattern differs in the root region of the deciduous molar from that in the cervical region of a permanent tooth, a more sigmoid shape being characteristic of the permanent premolar. It seems probable therefore that the shape and perhaps the divergence of the roots depend to a large extent on the balanced interrelationship between the length of time the odontoblasts are actively forming dentine and the variation in the rate of dentine formation, as well as the outline configuration of the epithelial rootsheath.

Summary

The growth of human dentine was investigated in an extracted deciduous lower second molar exhibiting more than twenty-six tetracycline lines. It was concluded that:

1. The pattern of differential growth in lower deciduous molars differs from that in permanent molars.
2. These differences are probably due to variations in the pattern of the odontoblast's activity during its life cycle.
3. The dentine of the floor of the pulp-chamber which constitutes the interradi-cular dentine grows generally more slowly but steadily than elsewhere.

References

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